FACT SHEET
UNITED STATES AIR FORCE

Defense Support Program


An artist's rendering of the DSP on orbit. Art courtesy TRW.

Air Force Defense Support Program satellites provide early detection and warning of missile launches and nuclear explosions to National Command Authorities and operational commands. The satellite constellation has been the cornerstone of North America's early warning system for more than 30 years.

The Air Force DSP satellites orbit the earth about 35,780 kilometers over the equator in geosynchronous orbits. DSP satellites use infrared sensors to detect heat from missile and booster plumes against the earth's background. In 1995, the Air Force implemented a new data processing system called Attack and Launch Early Reporting to Theater (ALERT). This ALERT capability provides improved warning of attack by short-range ballistic missiles against United States and allied forces overseas.

The Defense Support Program grew out of the successful 1960s space-based infrared Missile Defense Alarm System known as MiDAS. The first successful launch of MiDAS was May 24th, 1960. Between 1960 and 1966, there were 12 MiDAS launches deploying four different types of increasingly sophisticated sensors - sensors which led the way to the development, launch and use of the DSP. The Air Force Space and Missile Systems Center declassified this ballistic missile early warning satellite system program Nov. 30, 1998.

On November 6, 1970, the U.S. Air Force launched a classified satellite on a Titan IIIC rocket from Launch Complex 40 at Cape Canaveral Air Force Station, Florida. The secret mission of the spacecraft aboard the Titan was to provide early warning for Inter-Continental Ballistic Missiles launches from the Soviet Union and the People's Republic of China as well as Sea-Launched Ballistic Missiles near North America. That classified satellite became the first of 20 to be launched over the last 30 years with five major design changes that have improved the reliability, capability and service life of the spacecraft.


An early DSP satellite

DSP Evolution

The original DSP used 2,000 lead-sulfide infrared detectors, weighed 2,000 pounds, had 400 watts of electrical power and a design life of 1.25 years. In the 1970s, the Air Force and industry contractor team upgraded the satellite to meet new mission requirements. As a result, the satellite's weight grew to 3,690 pounds, the power increased to 680 watts, the number of detectors increased by threefold to 6,000 and the design life improved to three years with a goal of five years. Some of the later spacecraft have operated for more than 10 years - well past design lifetime. When fully deployed, a current generation DSP satellite is about 10 meters long and 6.7 meters in diameter.

Numerous improvement projects have enabled DSP to provide accurate, reliable data in the face of evolving missile threats. The addition of a medium wavelength infrared capability provided enhanced missile warning mission utility. This upgrade marked the first space sensor application of

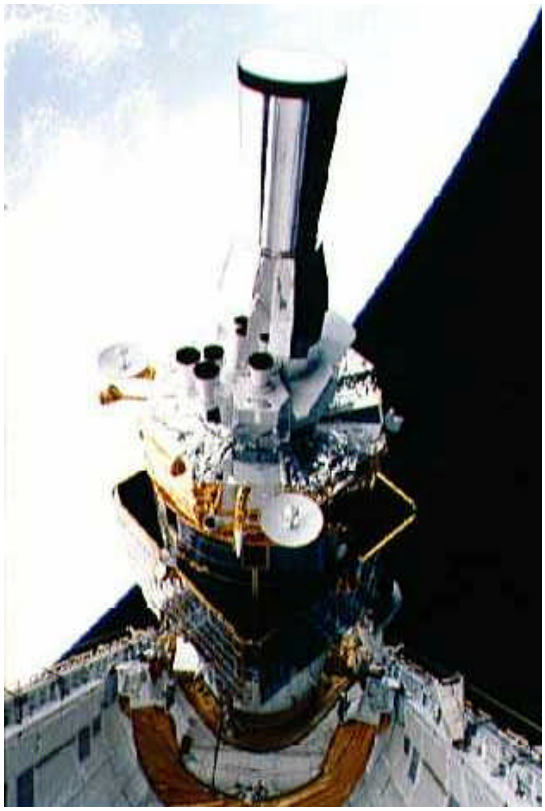
mercury cadmium telluride infrared sensors - the material of choice for today's infrared sensors. The current DSP spacecraft is more survivable than its predecessors, accommodates 6,000 detectors, uses 1,274 watts of power and weighs 5,200 pounds.

Early in the program, TRW engineers pioneered a "zero momentum" technique that allows the spacecraft to control its attitude with minimum fuel expenditure. They developed a mechanical solution called Inertial Properties Adjustment Device that enables the vehicle's spin axis to be fine-tuned - saving large amounts of fuel. Recent technological improvements in sensor design include above-the-horizon capability for full hemispheric coverage and improved resolution. Increased on-board signal-processing capability improves clutter rejection. Enhanced reliability and survivability improvements were also incorporated. Over the last 31 years, there have been 20 satellite launches with five major design changes. These "blocks" of satellites are:

Block 1: Phase I, 1970-1973, 4 satellites
Block 2: Phase II, 1975-1977, 3 satellites
Block 3: Multi-Orbit Satellite Performance Improvement Modification (MOS/PIM), 1979-1984, 4 satellites
Block 4: Phase II Upgrade, 1984-1987, 2 satellites
Block 5: DSP-1, 1989 - present, 7 satellites launched to date

During the 1991 war with Iraq, Defense Support Program satellites detected the launch of Iraqi SCUD ballistic missiles fired against coalition forces in Saudi Arabia or at civilian targets in the State of Israel. The DSP satellites provided the United Nations coalition forces and citizens in the State of Israel and the country of Saudi Arabia several minutes warning to prepare for incoming ballistic missile warhead impact. U.S. Army Air and Missile Defense units fired Patriot surface-to-air missiles at many of the incoming ballistic missiles in an effort to prevent SCUD warheads from striking their intended military target.

Launches and Satellite Operations



DSP 16 is checked out prior to release from Space Shuttle Atlantis. NASA photo.

Historically, DSP satellites have been launched atop the Titan III & IV family of launch vehicles; one was launched aboard NASA's Space Shuttle. Currently, Defense Support Program satellites are launched into geosynchronous orbit using a Lockheed Martin Titan 4B launch vehicle with a Boeing Inertial Upper Stage. After release from either the Titan or Space Shuttle, the satellite is boosted into an intermediate transfer orbit using an Inertial Upper Stage commonly referred to as an IUS.

DSP-16 launched aboard NASA's Space Shuttle Atlantis mission STS-44 (Nov. 24, 1991), and the satellite remains compatible with both the Space Shuttle and Titan 4B launch systems. DSP-23 is scheduled to launch aboard the second Boeing Delta 4 Evolved Expendable Launch Vehicle in August 2003.

After launch, Air Force Space Command controllers at Schriever Air Force Base in Colorado gradually move the satellite into its geosynchronous operational parking slot over the equator. Within several days of the launch, a team comprised of specialists from the DSP program office here, the Aerospace Corporation, TRW and Aerojet will begin on-orbit checkout of the satellite from the TRW Orbital Test Station in Redondo Beach, Calif. The systems checkout and test can take up to 30 days before the satellite is deemed operational and turned over to Air Force Space Command for use. The 21st Space Wing at Peterson AFB, Colo., operates the DSP satellites and reports

warning information to the North American Aerospace Defense Command and U.S. Space Command early warning centers in Cheyenne Mountain (near Colorado Springs).

In recent years, scientists have been developing methods to use the DSP's infrared sensor as part of an early warning system for natural disasters like volcanic eruptions and forest fires. With the DSP satellite constellation scanning nearly all of the earth's surface once every 10 seconds, emergency response agencies could have a tremendous tool for early detection and warning of potential natural threats to people. The DSP has been used by researchers at The Aerospace Corporation to develop portions of a Hazard Support System that will aid public safety in the future.

The development and acquisition of the Defense Support Program satellites is managed by the Space Based Infrared System Program Office at the Air Force Space and Missile Systems Center (Air Force Materiel Command) at Los Angeles Air Force Base, Calif. The Lockheed Martin Astronautics Titan launch vehicle, The Boeing Company's Inertial Upper Stage and the TRW and Aerojet built satellite are integrated at Cape Canaveral Air Station Florida by the 45th Space Wing's 3rd Space Launch Squadron. The operation of the DSP satellite is under the control of the Air Force Space Command's 50th Space Wing at Schriever Air Force Base.

Data for Defense Support Program Satellites

Primary mission:
Strategic and tactical missile launch detection

Contractor team:
TRW and Aerojet Electronics Systems

Orbital Altitude: 35,780 kilometers // 19,320 nautical miles // 22,233 statute miles

Power Plant:
Solar arrays generating 1,485 watts of power (satellite uses 1,274 watts)

Height: 32.8 ft. (10 meters) on orbit; 28 ft. (8.5 meters) at launch

Weight: 2,386 kilograms // 5,250 pounds

Diameter: 22 ft. (6.7 meters) on orbit; 13.7 ft. at launch

First Deployed: November 6, 1970

Last Launch: May 8, 2000

Unit Cost: Approximately $256 million

DSP 21 awaits mass properties testing at TRW's Redondo Beach facility. TRW photo.